

Express Mailing# EV220476488US

**AIR BAG SENSOR MODULE FASTENING DEVICE**

[0001] This application is a Continuation of United States Patent Application Serial Number 09/592,080 filed on June 12, 2000.

**BACKGROUND OF THE INVENTION**

[0002] This invention relates to air bag sensor modules that are secured to the vehicle structure for transmission of crash pulses, and more specifically, the invention relates to a fastening device for securing the module to the vehicle structure.

[0003] Air bag sensor modules include a crash sensor and are mounted on the vehicle structure in a manner to transmit crash information from the vehicle structure to the crash sensor. Diagnostic circuits evaluate the crash information and discriminate between a fire and a no fire condition. To this end, the air bag sensor module is mounted on the vehicle such that the crash sensor will be subject to forces that indicate a crash condition. For example, the crash sensor usually comprises an accelerometer and the air bag module is rigidly coupled to a portion of the vehicle such that deceleration indicative of a crash condition is transmitted to the crash sensor. When a crash condition requiring air bag deployment is detected, the controller associated with the air bag module sends a signal to ignite an air bag deployment device.

[0004] To ensure that the forces are properly transmitted from the vehicle structure to the crash sensor, the module must be securely fastened to the vehicle structure. Typically, the manufacturer of the module supplies the module to the vehicle manufacture, which provides the fastening elements used to secure the module to the vehicle structure and installs the module onto the vehicle structure. Preferably,

the fastening elements are secured to the vehicle structure only under the compressive load of a threaded fastener to ensure optimal crash pulse transmission. By having the vehicle manufacturer supply the necessary fastening elements, variables are introduced that may compromise proper installation of the module and inhibit crash pulse transmission. For example, the threads of the fastener may engage both the module and the vehicle structure so that the module is not secured to the vehicle structure by compressive load alone. Additionally, the shaft of the fastener may be in an interference fit relationship with a module mounting hole, again preventing the module from being secured to the vehicle structure by compressive load alone. Therefore what is needed is a fastening device which secures the module to the vehicle structure only by the compressive load of the fasteners to ensure optimal crash pulse transmission.

### **SUMMARY OF THE INVENTION AND ADVANTAGES**

[0005] The present invention provides an air bag sensor module fastening device for a vehicle. The fastening device includes a vehicle mounting structure having an internally threaded member. A sensor is secured to a base for sensing vibrations caused by a crash of the vehicle. The base has an aperture extending therethrough that is aligned with the internally threaded member. The aperture includes a retaining portion. A fastener for securing the base to the vehicle mounting structure has a shaft with a head and a threaded portion opposite the head.

[0006] The threaded portion is temporarily retained within the retaining portion in a shipping position. The threaded portion has a minor diameter and the shaft portion has a shaft diameter less than the minor diameter. As a result, the shaft will not be in an interference fit relationship with the retaining portion so that the

compressive load of the fastener alone secures the base to the vehicle mounting structure. The threaded portion is disposed outside of the retaining portion in an installed position in which the threaded portion is received in the internally threaded member to secure the base to the vehicle mounting structure. In this manner, the threaded portion will engage only the internally threaded member so that the base is secured to the vehicle mounting structure by the compressive load of the fastener alone.

[0007] Accordingly, the above invention provides a fastening device which secures the module to the vehicle structure only by the compressive load of the fasteners to ensure optimal crash pulse transmission.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] Other advantages of the present invention can be understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0009] Figure 1 is a partial cross-sectional side view of an air bag sensor module of the present invention fastening device with a fastener in shipping and installed positions;

[0010] Figure 2 is side view of the fastener of the present invention; and

[0011] Figure 3 is an enlarged partial cross-sectional view of the fastener in a transient position preceding the installed position.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

[0012] An air bag sensor module 10 for a vehicle is shown in Figure 1. The module 10 includes a fastening device 12 that has a vehicle mounting structure 14

with an internally threaded member 16. As shown in Figures 1 and 3, the internally threaded member 16 may be a nut that is secured to one side of the mounting structure 14 and aligned with a hole 18 in the structure 14. The internally threaded member 16 may also be integrally formed with the mounting structure such as a hole through the mounting structure 14 that specially adapted to receive and retain a fastener. The module 10 has a base 20 with a sensor 22 secured thereto for sensing vibrations caused by a crash of the vehicle. The sensor 22 and base 20 may be formed as single unit or as separate components. Typically, the base 20 includes a protrusion 24 that is received within a locating hole 26 in the mounting structure 14 for positioning the module 10 relative to the structure 14. The base 20 may be manufactured from plastic or metal.

[0013] The base 20 has an aperture 30, typically three or four, extending through the base 20 and positioned to align with the internally threaded members 16. The aperture 30 includes a retaining portion 32 and preferably a pocket 34 adjacent to the retaining portion 32. Fasteners 36 are received within the apertures 30 for securing the base 20 to the vehicle mounting structure 14. Referring to Figure 2, the fastener 36 has a shaft 38 with a head 40 and a threaded portion 42 opposite the head 40. Threads 44 on the threaded portion 42 are enlarged in the Figure for clarity. The shaft 38 has a shaft diameter X, and the threaded portion 42 has a minor diameter Y defined by the root or valley of the threads 44.

[0014] The fastener 36 has a shipping position (shown on the left side of Figure 1), an installed position (shown on the right side of Figure 1), and a transient position (shown in Figure 3) in which the fastener 36 is being moved from the shipping position to the installed position. The threaded portion 42 is temporarily retained within the retaining portion 32 in a shipping position so that the module 10

may be shipped with the fasteners 36 to avoid variables leading to poor crash pulse transmission, discussed above. The retaining portion 32 has threads 46 that have a retaining portion minor diameter Z defined by the crest or peak of the threads 46. The threaded portion 42 may be received in the retaining portion 32 by an interference fit or the base 20 may be molded or cast about the threaded portion 42. If the base 20 is molded or cast about the threaded portion 42, the retaining material will be disposed within the retaining portion 32, which will prevent the fastener from being installed into the internally threaded member 16. Self-tapping threads may be used to cut through the retaining material when moved from the shipping position to the installed position.

**[0015]** The present invention provides a fastener 36 with a threaded portion 42 having a minor diameter Y greater than the shaft diameter X. Similarly, the minor diameter Z of the retaining portion 32 will also be greater than the shaft diameter X. As a result, the shaft 38 will not be in an interference fit relationship with the retaining portion 32 so that the compressive load of the fastener 36 alone secures the base 20 to the vehicle mounting structure 14. Said another way, the minor diameter Z of the retaining portion 32 will not engage the shaft 38 because the shaft diameter X is smaller than the minor diameter Z.

**[0016]** As discussed above, it is undesirable to have the threaded portion 42 engage both the base 20 and the internally threaded member 16. Accordingly, it is preferable to have the threaded portion 42 disposed outside of the retaining portion 32 when in the installed position so that the threaded portion 42 only engages the internally threaded member 16. In this manner, the threaded portion 42 will engage only the internally threaded member 16 so that the base 20 is secured to the vehicle mounting structure 14 by the compressive load of the fastener 36 alone. To this end,

the present invention utilized a fastener 36 that has a shaft length S greater than the retaining portion depth R. If the base 20 does not have a pocket 34 as shown in the Figures, then the shaft length S may need be the greater than the depth of the aperture 30.

[0017] The invention has been described in an illustrative manner, and it is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation. Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.